

A REVISION OF THE PAPUASIAN SPECIES OF
ACMENA (MYRTACEAE)

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IN THE MOST RECENT taxonomic work dealing with the Papuan species of *Acmena* DC. (Merrill & Perry, 1938 & 1942), six species were recognized for the area: four endemic, *A. dielsii* Merr. & Perry, *A. dispansa* (Ridley) Merr. & Perry, *A. laevifolia* (Ridley) Merr. & Perry, and *A. polyantha* (Lauterb. & K. Schum.) Merr. & Perry; one Indo-Malesian, *A. acuminatissima* (Bl.) Merr. & Perry; and one common to western Papua New Guinea and eastern Australia, *A. hemilampra* (F. Muell. ex F. M. Bailey) Merr. & Perry. At the time these studies were made, only a very few Papuan collections of *Acmena* were available (six were cited in the former paper and eight were cited in the latter); thus it is not surprising that now, with nearly eight times the number of collections at hand, we can see the need for some changes and additions.

We are of the opinion that three of the species Merrill and Perry recognized, *A. dielsii*, *A. laevifolia*, and *A. polyantha*, are more correctly placed in synonymy, and we recognize, among collections that have been made since their studies, three new species. In addition, we have found that the Papuan *Syzygium triphlebium* Diels, which was accepted in *Syzygium* by Hartley and Perry (1973), is more correctly placed in *Acmena*, and that *Syzygium acmenoides* Merr. & Perry, which was informally referred to *Acmena* by Hartley and Perry (1973: 220), is correctly placed in *Syzygium*. The purpose of this paper is to revise the Papuan species of *Acmena* in view of this new information.

As Merrill and Perry pointed out (1938), *Acmena* ranges from mainland Asia throughout Malesia to the Solomon Islands and south to northern and eastern Australia. We have restricted this study to the Papuan species because we believe it is advisable to study *Acmena* in conjunction with *Syzygium*, and our work on the latter genus, continuing that of Hartley and Perry (1973), is limited to that region. The Australian species of *Acmena* and *Syzygium* are being studied by B. P. M. Hyland, C.S.I.R.O. Division of Forest Research.

Specimens cited in this paper are deposited at the British Museum (Natural History), London (BM), the Queensland Herbarium, Brisbane (BRI), the C.S.I.R.O. Herbarium Australiense, Canberra (CANB), and the Rijksherbarium, Leiden (L). We wish to thank the directors and curators of these herbaria for making specimens in their care available to us. Thanks are also extended to the curator and staff of the Canberra Botanic Gardens for the opportunity to study living material of *Acmena smithii* (Poiret) Merr. & Perry.

Acmena DC. Prodr. 3: 262. 1828. (For details of generic typification and synonymy see Merrill & Perry (1938) and Johnson, Contrib. New S. Wales Natl. Herb. 3: 100. 1962.)

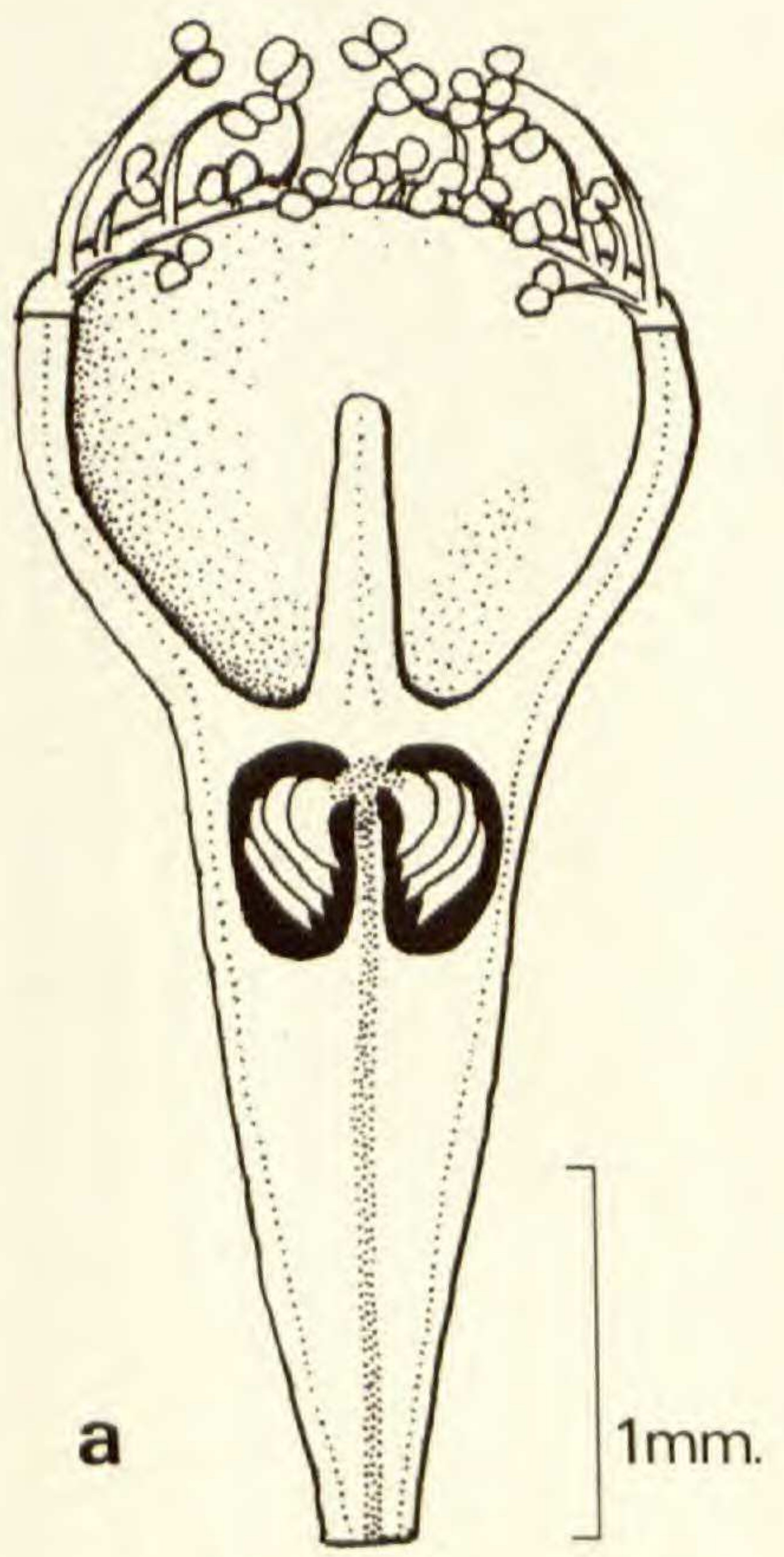
Lomastelma Raf. Sylv. Tellur. 107. 1838 (reference not seen).

Xenodendron Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsche Schutzgebiete Südsee 461. t. 16. 1900.

Trees or shrubs; buds with scales completely enclosing the leaf and floral primordia. Leaves opposite or subopposite, simple, oil-dotted, entire, with open venation (as defined by Hartley & Perry, 1973: 175), main veins confluent near the leaf margin to form one or two intramarginal veins. Inflorescences terminal and/or from the axils of the upper leaves, paniculate. Flowers bisexual; calyx tube turbinate to funnel-shaped; calyx lobes 4 or 5, minute or obsolete; petals 4 or 5, distinct, imbricate, caducous; stamens numerous, apparently in 2 or 3 series at the top of the hypanthium; filaments flexuous, of various lengths, those of the inner series of stamens shortest, those of the outer series longest; anthers minute; anther sacs globose or subglobose, divaricate, apically dehiscent by a pore or slit; ovary inferior, 2-locular; placentation upper axile; ovules (3–) 5–19 per locule, campylotropous, pendulous, elongate; style 1, straight, stigma scarcely differentiated. Fruit drupaceous, globose, with fleshy mesocarp and subwoody endocarp. Seed 1, globose; testa and endosperm absent; cotyledons 2, chlorophyllous, oil-dotted, thickened, enclosing an intrusive, ramifying mass of placental tissue, outer surfaces plane, inner surfaces ruminant and interlocked with the placental tissue; hypocotyl minute, external or slightly internal; epicotyl with two scale leaves.

The structure of the seed of *Acmena* is very unusual and has been variously interpreted (see Merrill & Perry, 1938: 6, 7, who also discuss some earlier references; Henderson, 1949: 10. fig. 5; and Kausel, 1957: 607, 608). We have studied the development of the seed from the ovule through to maturity and germination, using, to a large extent, living material of the Australian endemic *A. smithii*. We have concluded that it lacks a testa and endosperm, and that the cotyledons, at least in *A. smithii*, are distinct. The cotyledons enclose a branching mass of tissue which appears to be placental in origin and function. Details of this development are given below and are illustrated in FIGURE 1.

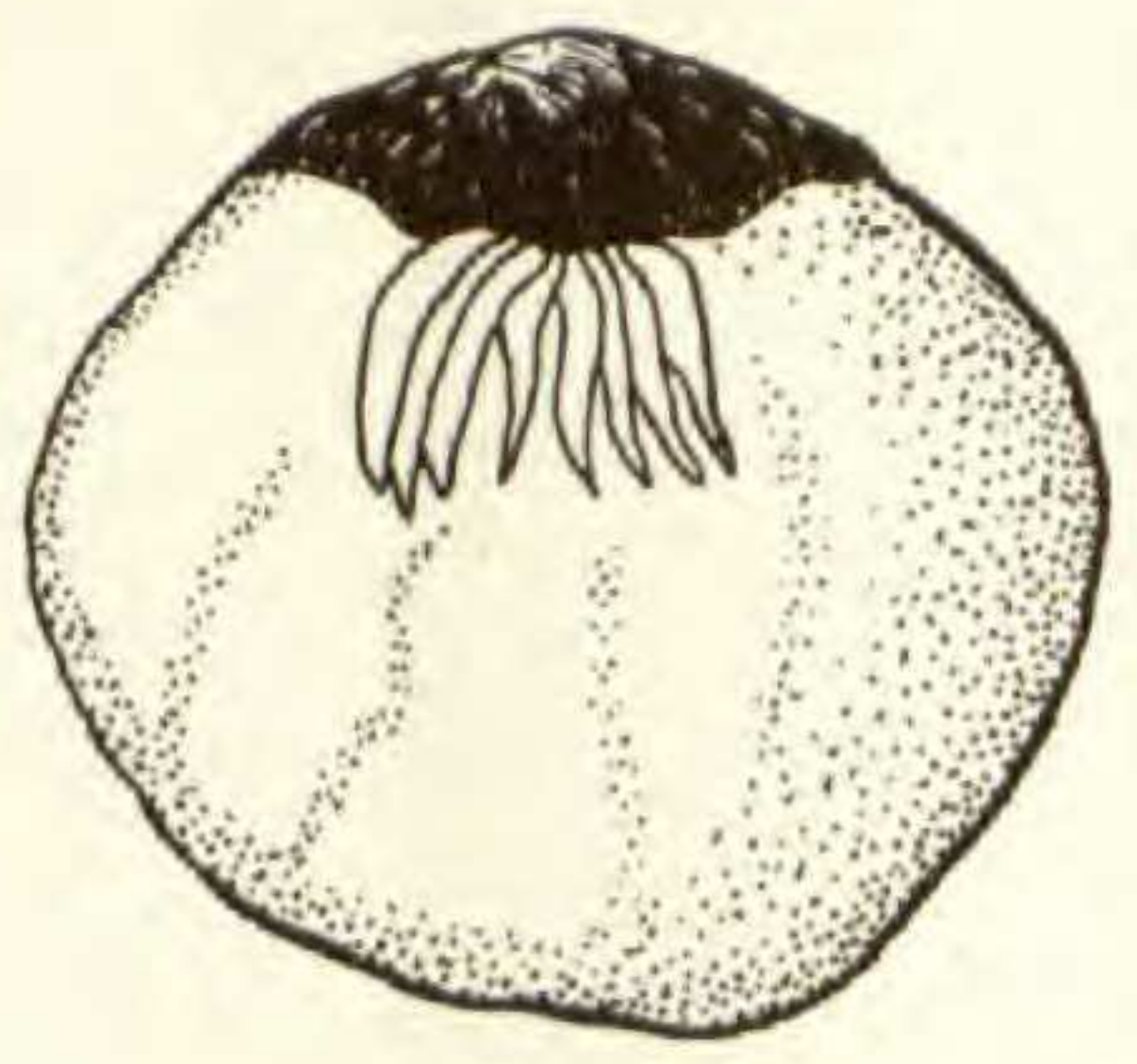
FIGURE 1. Seed development in *Acmena smithii* (Poiret) Merr. & Perry. a, longitudinal section of flower at anthesis. b, seed at early stage of development (removed from ovary). Shown are the hilum-like area of placental tissue, the aborted ovules, and the "integument" (partially stippled), which surrounds the embryo at this early state. c, seed at later stage of development (removed from young fruit). One cotyledon has been removed. Shown are the remaining cotyledon (non-shaded) with attached hypocotyl and the two scale leaves of the epicotyl, the branching mass of intercotyledonary placental tissue, and, continuous with it, the hilum-like area of placental tissue. d, longitudinal section of the mature fruit (diagrammatic). Shown are the outer, fleshy portion of the fruit (non-shaded), the subwoody endocarp (hatched), and the seed, the latter consisting of a naked embryo (non-shaded) and a branching mass of placental tissue (dark-shaded). A portion of the line of demarcation between the two cotyledons is shown at the lower end of the embryo.



a

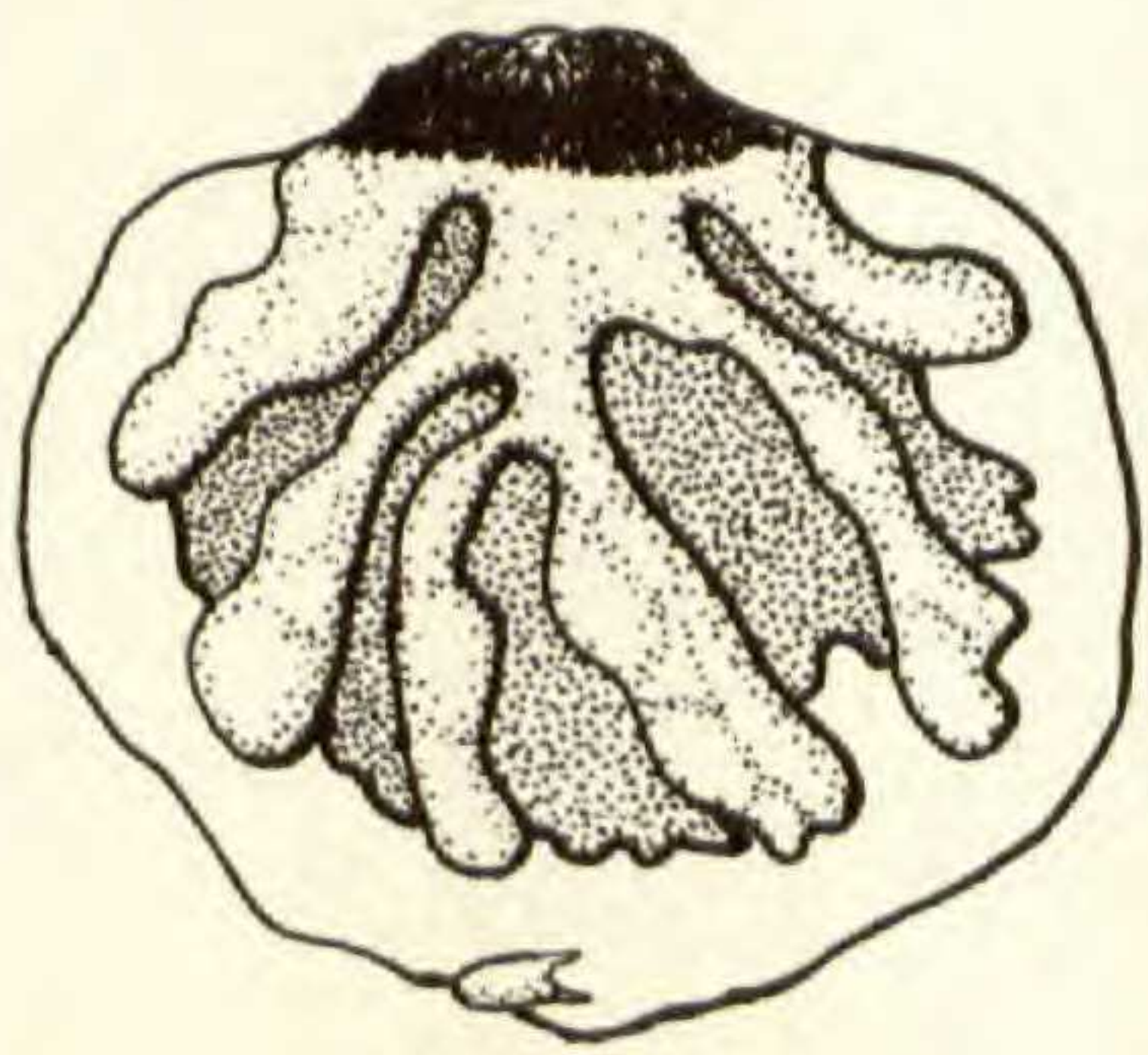
1mm.

TGH



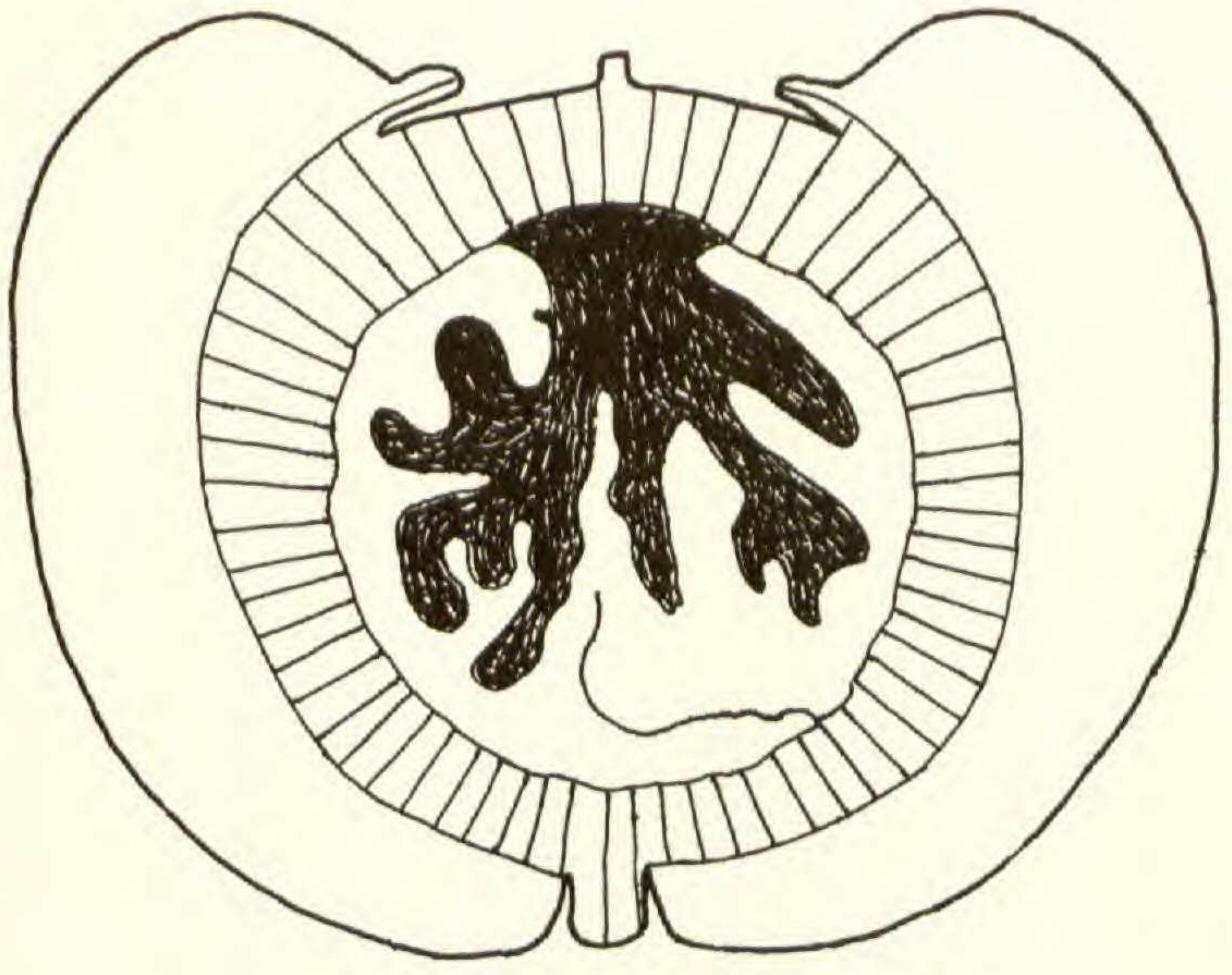
b

1mm.



c

1mm.



d

5mm.

In the flower at anthesis (FIGURE 1a), the ovules are attached to a four-lobed, upper-axile placenta, two lobes of which protrude into each of two locules. The vascular supply to the placenta is in the form of a single strand which extends from the base of the flower up through the center of the ovary. According to Schmid (1972: 451. *figs. 3-16*), in a study which includes a detailed account of the floral anatomy of *Acmena smithii*, this strand consists of numerous vascular bundles. The ovules, which are usually about 14 per locule in *A. smithii*, are elongate, pendulous, and sessile. Each locule is bounded by a tissue that is compact in comparison to the surrounding ovary tissue, which is spongy.

Following fertilization, a single ovule of the flower develops into a seed. As this development progresses, the locule containing the developing seed enlarges and becomes central-apical in its position in the ovary. The other locule, containing only aborted ovules, is flattened against the upper side of the expanding locule. At the point of attachment of the developing seed, the placenta enlarges and, in part, appears to grow through the funicular region and into the embryo sac. At the stage illustrated in FIGURE 1b (which shows a very young seed removed from the locule), this placental tissue is visible externally as a broad, hilum-like structure. Internally, it has grown part way between the cotyledons of the developing embryo and has begun to branch. Enclosing the embryo, but not the "hilum," is a thin, delicate tissue which is probably a single integument. External to this "integument," and attached to the "hilum," are the aborted ovules of the locule. At this stage, the embryo consists of two separate, sub-orbicular cotyledons and an external hypocotyl. There is no evidence that endosperm is formed.

As development continues, the cotyledons and the inter-cotyledonary mass of placental tissue enlarge, and the latter becomes increasingly complex in its branching. Early in this enlargement the "integument" is sloughed off. At the stage of development shown in FIGURE 1c, the "integument" has disappeared, the cotyledons are still quite distinct and are easily separable, both from one another and from the intercotyledonary placental material, and the hypocotyl and two scale leaves of the epicotyl are visible at the lower end of the developing embryo.

As the seed approaches maturity, the embryo, in conforming with the irregularities of the increasingly branching intercotyledonary material, grows more and more unevenly. As a result, the external line of demarcation between the two cotyledons, which was fairly straight in the early stages of seed development, becomes increasingly distorted and difficult to follow. Also, the cotyledons become interlocked, or dovetailed, with the intercotyledonary material. This dovetailing usually makes it impossible to separate the cotyledons from the intercotyledonary material without tearing them. We have not seen evidence, however, that the cotyledons themselves are actually grown together (conferruminate), as most previous authors have thought. A further result of the uneven growth of the embryo is that the position of the hypocotyl may be altered; thus in some seeds it is external and in others it is slightly internal.

We may be incorrect in referring to the intercotyledonary material as placental. Nevertheless, it seems to be continuous, throughout its development, with the tissue to which the ovules are attached. Also, it contains branching vascular tissue that is continuous with the axile vascular strand of the flower, and, in its close and intricate contact with the inner faces of the cotyledons, it provides an extensive surface for the possible diffusion of food into the developing embryo.

The fleshy mesocarp of the fruit is derived from the calyx tube, and the subwoody endocarp develops mainly from the ovary wall (FIGURE 1d). The fruits of *Acmena* are eaten by birds (including, in north Queensland, the cassowary, *Casuarius casuarius*; the top-knot pigeon, *Lopholaimus antarcticus*; the wompoo pigeon, *Ptilinopus magnificus*; and the purple-crowned pigeon, *Ptilinopus superbus* — Frank Crome, C.S.I.R.O. Division of Wildlife Research, pers. comm.). It is probable that the endocarp prevents digestion of the seed.

During seed germination, which is hypogeal, the cotyledons remain together, closely interlocked with the intercotyledonary placental material. Under natural conditions, germination does not occur until the endocarp has sufficiently softened or rotted away to allow emergence of the root and shoot of the seedling. The scale leaves do not enlarge appreciably upon germination and appear at the first node of the seedling. Two additional nodes of similar scale leaves appear before the seedling produces a pair of functional foliage leaves at the fourth node.

The cotyledons apparently provide food for the developing seedling; the intercotyledonary material does not seem to have a nutritive function at this stage. By the time the seed has reached maturity, it is composed, apparently entirely, of non-living tissue. In this final state it is remarkably similar in texture and color to the carpellary dissepiments (which are also placental in origin) to which the seeds are attached in the fruits of *Flin-dersia* (Rutaceae), being hard, brittle, and dark reddish brown in color.

The closest generic affinities of *Acmena* appear to be found in *Acmenosperma* Kausel, a recently described monotypic genus based on the Indo-Malesian *Eugenia claviflora* Roxb. (*Syzygium claviflorum* (Roxb.) Cowan & Cowan), and *Piliocalyx* Brongn., a genus of nine species, eight endemic to New Caledonia and one endemic to Fiji. The seeds of both of these genera are similar to those of *Acmena*, having branching intercotyledonary placental tissue. *Acmena*, *Acmenosperma*, and *Piliocalyx* may be distinguished as follows:

- | | |
|--|-----------------------|
| 1. Calyx tube calyptrate at the summit. | <i>Piliocalyx</i> . |
| 1. Calyx tube lobed or undulate at the summit. | |
| 2. Anther sacs globose or subglobose, divaricate, apically dehiscent by a pore or slit. | <i>Acmena</i> . |
| 2. Anther sacs elongate, parallel, laterally dehiscent by a longitudinal slit. | <i>Acmenosperma</i> . |

Kausel (1957) has proposed (but apparently not validly published) a new subfamily, the Acmenoideae, for these three genera. We agree that

they seem to form a natural group, but doubt that they occupy a sufficiently remote evolutionary position from *Syzygium* to warrant placement in a separate subfamily. *Acmenosperma claviflora* (Roxb.) Kausel seems to stand in an intermediate position between *Acmena* and *Syzygium sensu stricto*, having the basic seed structure of the former and the anther characteristics of the latter.

Measurements given in the taxonomic section which follows are all based on dried material. It should be noted that mature fruits shrink to about one half their fresh size with drying. The flower and fruit colors given are based on collectors' notes.

The descriptions of the two species which are also known outside Papuasia, *Acmena acuminatissima* and *A. hemilampira*, are based only on Papuan specimens.

We have not been able to arrange the species in a phylogenetic sequence, nor are we at all sure of their interrelationships. For these reasons we have arranged them alphabetically in the taxonomic section. We suspect, as did Merrill and Perry (1938), that fruit and seed characteristics might provide a basis for a natural classification, but the material at hand is unsuitable for a detailed and comprehensive study of these organs. Besides shrinking, as mentioned above, the fruits of the Papuan species become extremely hardened with drying and are very difficult to work with, even after prolonged soaking and boiling.

KEY TO THE SPECIES

(based on flowering material)

1. Calyx tube 6–10 mm. long.
 2. Leaf blades lanceolate, 20–45 cm. long, 4.5–11 cm. wide, main veins 12–16 on each side of the midrib. 6. *A. sorongensis*.
 2. Leaf blades elliptic or occasionally sublanceolate, (12–)15–33 cm. long, (4.5–)7–16 cm. wide, main veins 7–10(–16) on each side of the midrib. 5. *A. montana*.
1. Calyx tube 2.5–5 mm. long.
 3. Leaf blades 5–10 cm. long.
 4. Calyx tube 4–5 mm. long; leaf blades narrowly elliptic, at least 6 times as long as broad, apex acuminate. Rheophyte. 3. *A. fluvicola*.
 4. Calyx tube 3–4.5 mm. long; leaf blades not more than 4 times as long as broad.
 5. Leaf blades elliptic to subobovate, apex obtuse to shortly and bluntly acuminate. 4. *A. hemilampira*.
 5. Leaf blades lanceolate to elliptic, apex acuminate to cuspidate. 1. *A. acuminatissima*.
 3. Leaf blades 10–24 cm. long.
 6. Veins conspicuously paler than the brownish leaf blade surface; calyx tube 2.5–3 mm. long. 7. *A. triphlebia*.
 6. Veins not conspicuous as above; calyx tube 3–5 mm. long.
 7. Leaf blades drying glossy dark brown above, main veins about 12 on each side of the midrib; calyx tube 3 mm. long. 2. *A. dispansa*.

7. Leaf blades usually drying dull grayish above, main veins 7-15 on each side of the midrib; calyx tube 3-5 mm. long. 1. *A. acuminatissima*.

KEY TO THE SPECIES
(based on fruiting material ¹)

1. Leaf blades 5-10 cm. long.
 2. Leaf blades more than 6 times as long as broad. 3. *A. fluvicola*.
 2. Leaf blades less than 4 times as long as broad.
 3. Leaf blades elliptic to subobovate, apex obtuse to shortly and bluntly acuminate. 4. *A. hemilampira*.
 3. Leaf blades lanceolate to elliptic, apex acuminate to cuspidate. 1. *A. acuminatissima*.
1. Leaf blades more than 10 cm. long.
 4. Mature fruits white or cream.
 5. Veins conspicuously paler than the brownish leaf blade surface, main veins about 10 on each side of the midrib; mature fruiting pedicels about 1 mm. wide; mature fruits about 1 cm. wide. ... 7. *A. triphlebia*.
 5. Veins not conspicuous as above, leaf blade usually drying dull grayish above, main veins 7-15 on each side of the midrib; mature fruiting pedicels 1-10 mm. wide; mature fruits 1.5-4 cm. wide. 1. *A. acuminatissima*.
4. Mature fruits red or pink.
 6. Leaf blades lanceolate, 20-45 cm. long, 4.5-11 cm. wide, main veins 12-16 on each side of the midrib. 6. *A. sorongensis*.
 6. Leaf blades elliptic or occasionally sublanceolate, (12-)15-33 cm. long, (4.5-)7-16 cm. wide, main veins 7-10(-16) on each side of the midrib. 5. *A. montana*.

1. *Acmena acuminatissima* (Bl.) Merr. & Perry, Jour. Arnold Arb. 19: 12. 1938.

Myrtus acuminatissima Bl. Bijdr. 1088. 1826. TYPE: *Blume*, Java (not seen). (For other extra-Papuasian synonyms of *Acmena acuminatissima*, see Merrill & Perry, 1938.)

Xenodendron polyanthum Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsche Schutzgebiete Südsee 461. t. 16. 1900. TYPE: *Bamler 5*, Northeast New Guinea, Sattelburg (not seen).

Eugenia laevifolia Ridley, Trans. Linn. Soc. Bot. II. 9: 48. 1916. TYPE: *Kloss* (*Wollaston Expedition*), 1912-1913, West New Guinea, southern slopes of the Nassau Range.

Acmena polyantha (Lauterb. & K. Schum.) Merr. & Perry, Jour. Arnold Arb. 19: 11. 1938.

Acmena dielsii Merr. & Perry, loc. cit.: 18. TYPE: *Brass 675*, Papua, Gawarere.

Acmena laevifolia (Ridley) Merr. & Perry, loc. cit.: 18, 19.

Shrub or small to large tree to about 30 m.; branchlets glabrous to puberulent to finely pubescent, terete or compressed or rarely tetragonous,

¹ We have not seen fruits for species 2, 3, and 4, *A. dispansa*, *A. fluvicola*, and *A. hemilampira*. With the exception of *A. dispansa*, however, we have included them in this key since they are distinguishable by leaf characters.

1–5 mm. wide. Leaves entirely glabrous or puberulent to finely pubescent on the petiole and lower midrib; petiole 5–10 mm. long, 1–3 mm. wide; leaf blade chartaceous to subcoriaceous, usually drying grayish above, brownish below, usually dull on both surfaces, broadly to narrowly elliptic to lanceolate, (4–)9–21(–24) cm. long, (1.5–)2–7.5 cm. wide, base rounded to cuneate, apex acuminate to cuspidate. Inflorescences terminal or terminal and from the axils of the upper leaves, to about 15 cm. long, axis and branches glabrous to puberulent to finely pubescent. Flowers white; calyx tube 3–5 mm. long, at the base narrowed into a stipe 1.5–2 mm. long, at the apex 2–4 mm. wide; calyx lobes 0.25–0.5 mm. high; petals orbicular, 1–2 mm. wide; stamens 0.5–2 mm. long. Mature fruiting pedicels 1–10 mm. wide; mature fruits white, 1.5–4 cm. wide.

ILLUSTRATIONS. Engler, A., & K. Prantl, *Nat. Pflanzenfam. Ergänzungsh.* 2: 239. *fig. 33.* 1907 (as *Xenodendron polyanthum* Lauterb. & K. Schum.). Henderson, M. R., *Gard. Bull. Singapore* 12: 9. *fig. 4;* 263. *fig. 51a;* 264. *fig. 52.* 1949 (all as *Eugenia cumingiana* Vidal). Koorders, S. H., & Th. Valetton, *Atlas der Baumarten von Java* 3: *t. 506.* 1915 (as *Eugenia acuminatissima* Kurz). Lauterbach, C., & K. Schumann in K. Schumann & C. Lauterbach, *loc. cit.*

DISTRIBUTION. Irian Jaya, Papua New Guinea (including New Britain and Bougainville), and the Solomon Islands (also in western Malesia and mainland Asia, *vide* Merrill & Perry, 1938); primary and regrowth rain forests; usually in lowlands and foothills, but occasionally at higher elevations up to 2400 meters.

Irian Jaya. Vogelkop Peninsula, Oransbari, *Kokkelink BW 2293* (CANB); southern slopes of Nassau Range, Utakwa River, Camp 1, *Kloss (Wollaston Expedition)*, 1912–1913 (BM, holotype of *Eugenia laevifolia* Ridley); Bele River, 18 km. NE of Lake Habbema, *Brass & Versteegh 11142* (BRI); vicinity of Hollandia, mouth of Tami River, *Kalkman BW 3443* (CANB); vicinity of Hollandia, Lake Sentani, *van der Sijde BW 4001* (CANB). Papua New Guinea. SEPIK DISTRICT: Vanimo Subdistrict, about 1 km. from Ossima airstrip, *Katik NGF 46699* (BRI, CANB); Kokomo Creek, tributary of Frieda Creek, *Henty & Foreman NGF 42662* (BRI, CANB); near Ambunti, *Hoogland & Craven 10177* (CANB). EASTERN HIGHLANDS DISTRICT: Arona side of Kassam Pass, *Womersley NGF 46426* (CANB). MOROBE DISTRICT: Boana, *Clemens 8233A* (CANB); Sankwep River, *Womersley NGF 43722* (CANB); Busu River, *Henty NGF 12416* (BRI, CANB); Burep [Bupu] River NE of Lae, *Hartley 10117* (CANB), *10134* (CANB), *Millar NGF 12283* (BRI); Bunga River about 24 km. NE of Lae, *Hartley 12285* (BRI, CANB); near the Butibum River about 11.2 km. N of Lae, *Hartley 11444* (CANB); 24 km. W of Lae, *Streimann & Kairo NGF 47718* (CANB); Oomsis Creek 28.8 km. W of Lae, *Hartley 10040* (CANB), *Henty NGF 14369* (BRI, CANB); 4.8 km. S of the Garagos River bridge on Lae-Bulolo Road, *Hartley 11025* (CANB); Patep River, about 6.4 km. S of Gurukor, *Hartley 11000* (CANB); Edie Creek Road near Blue Point, *Havel & Kongara NGF 17322* (BRI, CANB); Kui, *Henty NGF 28095* (BRI); Posei village, 16 km. SW of Morobe, *Streimann NGF 24081* (CANB). NEW BRITAIN: Mt. Talawe, *Ridsdale NGF 30528* (BRI), *Frodin NGF 26838* (BRI, CANB); NE of Aisega village, *Frodin NGF 26696* (BRI, CANB); Cape

Hoskins, Malalia, *Floyd NGF 6553* (BRI, CANB). BOUGAINVILLE: lower south slopes of Lake Loloru crater, about 22 km. N of Buin, *Craven & Schodde 269* (CANB); vicinity of Barilo village, about 9.5 km. N of Buin Station, *Schodde & Craven 3964* (CANB); Siwai, *Waterhouse 128-B* (BRI, CANB), *475-B* (BRI). SOUTHERN HIGHLANDS DISTRICT: Anga Valley, near Ebenda, *Schodde 1539* (CANB). WESTERN DISTRICT: lower Fly River, east bank opposite Sturt Island, *Brass 7977* (BRI). CENTRAL DISTRICT: Tapini, *Lelean NGF 46390* (CANB); Isuarava, *Carr 15880* (CANB); Gawarere, *Brass 675* (BRI, isotype of *Acmena dielsii* Merr. & Perry); Kuriva Forestry Area, near Veimauri River, *Streimann & Kairo LAE 51516* (CANB); Brown River near Karema, *Schodde 2607* (CANB); Boridi, *Carr 14805* (CANB); Cape Rodney, near P.I.T. sawmill, T.P. 107, *Henty NGF 38613* (BRI, CANB). NORTHERN DISTRICT: Pongani Valley, between Dareki and Ondoro, *Pullen 5677* (CANB). MILNE BAY DISTRICT: eastern Mt. Simpson Range, Mt. Moiba, *Schodde 5356* (CANB). Solomon Islands. Guadalcanal, Tutuve Mountain, Unloto, *Kajewski 2553* (BRI).

As we interpret it, *Acmena acuminatissima* is polymorphic in Papuasias. Among the collections at hand, we can recognize three major entities, but for various reasons (discussed below) we prefer not to recognize any of them formally. It should be noted that Merrill and Perry (1938) saw very little of the variability that has led us to this much more conservative circumscription of this species. They cited only one Papuasian collection, *Kajewski 2553*, for *A. acuminatissima*, and, of the names we have placed in its synonymy, they only had fragments (of two collections) of *A. polyantha*, a single collection of *A. dielsii*, and a single flower of *A. laevifolia*.

Entity 1. Branches of the inflorescences (and often the branchlets, petioles, and lower midrib of the leaves) finely pubescent to puberulent; mature fruiting pedicels about 2.5 mm. wide; mature fruits about 2.5 cm. wide; leaf blades narrowly to broadly lanceolate or occasionally elliptic, 7.5–11 cm. long, acuminate to cuspidate at the apex; flowers with calyx tube 3–4.5 mm. long.

Seven of the collections cited above (and also the type collection of *Xenodendron polyanthum*) can be readily placed in this entity. These are *Clemens 8233A*, *Hartley 10117*, *10134*, *11000*, and *12285*, and *Streimann & Kairo NGF 47718*, all from the Morobe District; and *Carr 15880*, from the Central District. Seeming to grade toward a glabrous condition are *Hoogland & Craven 10177*, from the Sepik District, and *Brass 7977*, from the Fly River, both of which are only minutely puberulent; and *Kokkelink BW 2293*, from the Vogelkop, which is only minutely papillate (visible at about 20 \times). Examination of the variations in these vestiture types in single specimens reveals that there is complete intergradation from finely pubescent to puberulent to minutely papillate. The step from minutely papillate to the glabrous and smooth condition of the remaining Papuasian collections that we have placed in *Acmena acuminatissima* is but a short one, and it is probably safe to say that there is complete intergradation between the pubescent and glabrous plants. Examination of our western Malesian material of *A. acuminatissima* has revealed that two of the collections, *Kostermans & Kuswata 27*, from Java, and *Kos-*

termans 6785, from Borneo, are minutely papillate, while the other collections, which are from the Philippines, Borneo, and the Celebes, are glabrous and smooth. It appears, then, that the tendency toward pubescence may be of sporadic geographic occurrence in this species. We have attempted to find other characters of the pubescent plants which would aid in distinguishing them from those that are glabrous, but there seem to be none.

Entity 2. Plants entirely glabrous; mature fruiting pedicels about 1 mm. wide; mature fruits 1–2 cm. wide; leaf blades lanceolate to broadly elliptic, 5–18 cm. long, acuminate to cuspidate at the apex.

We have four glabrous collections with mature fruits in this size range: *van der Sijde* BW 4001, from Irian Jaya, and *Floyd* NGF 6553, *Frodin* NGF 26696, and *Ridsdale* NGF 30528, all from New Britain. On the basis of descriptions and specimens we have seen, the western Malesian material of *Acmena acuminatissima* closely matches this Papuasian material in fruit size, although there seems to be a difference in the color of the mature fruit. Collectors in Papuasias have invariably described it as white, whereas from Java (Bakhuizen f., Fl. Java 1: 337. 1963) and Malaya (Ridley, Fl. Malay Penin. 1: 747. 1922, and Henderson, 1949: 262) it has been described as being various shades of blackish red. It is probably also worth mentioning that *A. acuminatissima* is described as having stilt roots in Java (Bakhuizen f., *loc. cit.*), and as sometimes having them in Malaya (Henderson, 1949: 261). The presence of such roots was noted with the Frodin collection placed in this entity, and also with the type collection of *A. dielsii*, *Brass* 675, from the Central District, Papua New Guinea, a glabrous flowering collection not assigned to an entity.

Entity 3. Plants entirely glabrous; mature fruiting pedicels 5–10 mm. wide; mature fruits 3–4.5 cm. wide; leaf blades lanceolate to rather broadly elliptic, 12–22 cm. long, acuminate at the apex.

Glabrous Papuasian collections with fruits in this size range are as follows: *Hartley* 10040, *Henty* NGF 12416, *Millar* NGF 12283, *Streimann* NGF 24081, and *Womersley* NGF 43722, all from the Morobe District; and *Lelean* NGF 46390, *Schodde* 1539 and 5356, and *Streimann & Kairo* LAE 51516, all from the southern part of Papua New Guinea. In the large fruits and heavy, woody fruit stalks, these plants are strikingly different from those placed in Entity 2. We have not been able to correlate the fruit size differences with other characters, however.

Thus, we can readily sort pubescent plants into Entity 1, and glabrous fruiting collections into either Entity 2 or Entity 3. We have not been able to sort glabrous flowering collections, however, and these collections include the type collections of *Acmena dielsii* and *A. laevifolia*. The flowers of the glabrous material appear more or less identical except for size differences. The calyx tube ranges in length, without significant discontinuity, from 3 to 5 mm. We have one small-fruited collection with

both flowers and fruits, *van der Sijde BW 4001*, listed above under Entity 2. In this collection, the fruits are about 1 cm. wide and the flowers, which are in bud but appear to be nearly at anthesis, have a calyx tube about 4 mm. long. In the large-fruited entity there are no collections with both flowers and fruits. We are quite certain, however, that the flowering stage is represented by *Henty NGF 14369*, from Oomsis Creek, near Lae, because from that same locality we have a large-fruited collection, *Hartley 10040*, which is a good match vegetatively. The flowers of the Henty collection have a calyx tube 3.5–4 mm. long and they are not significantly different from those of the small-fruited *van der Sijde* collection. The leaves of the glabrous flowering collections range across the spectrum of shapes and sizes given above for Entities 2 and 3.

On the basis of the data given by collectors and our field experience in Papuasia, there is no reliable evidence of ecological specialization in the three entities of *Acmena acuminatissima*. They all appear to grow in both primary and regrowth rain forests over a fairly wide altitudinal range.

We have two collections, one from Irian Jaya (*Brass & Versteegh 11131*, Bele River, 18 km. NE of Lake Habbema, tree 20 m. tall in montane rain forest) and one from Papua New Guinea (*Craven & Schodde 1245*, Morobe District, Aseki Patrol Area, tree 28 m. tall in montane rain forest), that seem to be closely related to *A. acuminatissima* but differ in having narrower leaves (about 5 times as long as broad) and pustulate, as opposed to smooth or minutely papillate, inflorescence branches. We think they represent a distinct species, but their localities are so far apart (nearly 800 kilometers) that it seems best to defer formal recognition until more material is available. There are two other collections that may belong here: *Henty & Foreman NGF 42662*, from the Sepik District, which is in very early bud; and *Kalkman BW 6372*, from the Vogelkop Peninsula, which is sterile. The four collections are listed in the Index to Exsiccatae as *Acmena* aff. *acuminatissima*.

There are two further collections that are of uncertain identity which we have listed in the Index to Exsiccatae as *Acmena* aff. *acuminatissima*: *Streimann & Kairo, NGF 39397*, Morobe District, Wau Subdistrict, Palenkwa, Golden Pines, tree 24 m. tall in *Araucaria* forest; and *Womersley NGF 24926*, Eastern Highlands District, Okasa, canopy or emergent tree 33 m. tall in lower montane rain forest. Both of these collections have only immature fruits, but in the size of the fruiting pedicel they appear to belong to the large-fruited Entity 3 of *A. acuminatissima*. The leaves, however, tend to be obovate, which sets them apart from that species.

2. *Acmena dispansa* (Ridley) Merr. & Perry, Jour. Arnold Arb. 19: 18. 1938.

Eugenia dispansa Ridley, Trans. Linn. Soc. Bot. II. 9: 47. 1916. TYPE: *Kloss (Wollaston Expedition)*, 1912–1913, West New Guinea, southern slopes of Nassau Range.

Tree(?); branchlets glabrous, terete, 1.5–2 mm. wide. Leaves glabrous; petiole 6–8 mm. long, 1.5–2 mm. wide; leaf blade subcoriaceous, drying

glossy dark brown above, duller and paler below, narrowly elliptic to lanceolate, 10–20 cm. long, 2.5–4.5 cm. wide, base obtuse to acute, apex acuminate, main veins about 12 on each side of the midrib, prominent. Inflorescences terminal, to about 20 cm. long, glabrous. Flowers white (*vide* Ridley); calyx tube 3 mm. long, at the base narrowed into a stipe about 1 mm. long, at the apex 2 mm. wide; calyx lobes about 0.3 mm. high; petals orbicular, about 1 mm. wide; stamens 0.5–1 mm. long. Fruits not seen.

DISTRIBUTION. Known only from the type collection.

Irian Jaya. Southern slopes of Nassau Range, near Tsingarong River, Camp VIa and Camp VIc, alt. 900–1700 m., *Kloss (Wollaston Expedition)*, 1912–1913 (BM, holotype).

A collection from Ambon Island, in the Moluccas, *Kuswata & Soepadmo 257*, may also be this species.

The closest relative of *Acmena dispansa* may be *A. triphlebia*. Both have similarly brown leaves (when dry) and their flowers are of about the same size and color. They differ mainly in that the latter has paler veins.

3. *Acmena fluvicola* Hartley & Craven, sp. nov.

FIGURE 2.

Arbor gracilis usque ca. 5 m. alta; ramulis glabris, teretibus vel compressis, 1–2 mm. latis; foliis glabris; petiolo 5–8 mm. longo, ca. 1 mm. lato; lamina subcoriacea, in sicco supra nitida cinereo-brunnea, subtus obscure brunnea, anguste elliptica, 7–9 cm. longa, 1–1.3 cm. lata, basi cuneata, apice acuminata, venis primariis utrinsecus costa ca. 12, inconspicuis; inflorescentiis terminalibus et ex axillis foliatis superioribus orientibus, glabris, usque ca. 2.5 cm. longis; floribus albis; tubo calycis 4–5 mm. longo, basi stipitato (stipite 2–3 mm. longo), apice 2.5 mm. lato; lobis calycis 0.25–0.5 mm. altis; petalis orbicularibus, ca. 1 mm. latis; staminibus 0.5–1 mm. longis; fructibus non visis. HOLOTYPUS: *Brass 28857* (CANB).

DISTRIBUTION. Known only from the type collection.

Papua New Guinea. MILNE BAY DISTRICT: Dawa Dawa River, along flood-bank, alt. 10 m., *Brass 28857* (CANB, holotype).

Acmena fluvicola has willow-like leaves and appears to be restricted to stream banks. As far as we know it is the only rheophyte in the genus. We are at a loss to say what its closest relative might be; although there is a resemblance to the narrow-leaved plant referred to above as *Acmena* aff. *acuminatissima*, it seems to be superficial. The latter is not a rheophyte and has more conspicuous veins and pustular, as opposed to smooth, inflorescence branches.

4. *Acmena hemilampra* (F. Muell. ex F. M. Bailey) Merr. & Perry, Jour. Arnold Arb. 19: 15. 1938.

Eugenia hemilampra F. Muell. ex F. M. Bailey, Frag. Phytogr. Austral. 9: 145. 1875 (name merely proposed); Synop. Queensl. Fl. Suppl. 1: 23. 1886.



FIGURE 2. *Acmena fluvicola* Hartley & Craven. Flowering branchlet, lower surfaces of two leaves shown (drawn from *Brass* 28857).

SYNTYPES (none seen): *Moore*, New South Wales, Clarence River; *Hodgkinson*, New South Wales, Richmond River; *Carron*, New South Wales, Tweed River; *Thozet*, Queensland, Rockhampton; *Nernst*, Queensland, Mackay; *Dallachy*, Queensland, Rockingham Bay; *Curdie & Moore*, Queensland, Cape Sidmouth; *Hill*, Queensland, Russell River and Mt. Bellenden Ker; *Damel*, Queensland, Cape York.

Small to large tree to about 30 m. tall; branchlets glabrous, terete or compressed, 1–2 mm. wide. Leaves glabrous; petiole 5–10 mm. long, 1–2 mm. wide; leaf blade subcoriaceous, drying brownish (often slightly grayish above), somewhat glossy above, dull below, elliptic to subobovate, 5–10 cm. long, 1.5–3.5 cm. wide, base acute to cuneate, apex obtuse to shortly and bluntly acuminate, main veins 8–10(–12) on each side of the midrib, rather obscure. Inflorescences terminal and from the axils of the upper leaves, to about 10 cm. long, glabrous. Flowers white or cream; calyx tube 3–3.5 mm. long, at the base narrowed into a stipe about 2 mm. long, at the apex 1.5–2 mm. wide; calyx lobes obsolete to 0.1 mm. high; petals orbicular, about 1 mm. wide; stamens 0.5–1 mm. long. Fruits not seen.

DISTRIBUTION. Papua New Guinea, Fly River region (also in eastern Australia from Cape York Peninsula south to northeastern New South Wales, *vide* Merrill & Perry, 1938); gallery forests, rain forests, and woodlands; 15–30 meters.

Papua New Guinea. WESTERN DISTRICT: Lake Daviumbu, *Brass* 7766 (BRI), 7941 (BRI); near Weam, *Paijmans* 389 (CANB), *Ridsdale & Galore* NGF 33718 (CANB); Tarl River, branch of Bensbach River, *Paijmans* 349 (CANB), *Ridsdale & Galore* NGF 33712 (CANB); near Morehead Patrol Post, *Pullen* 7147 (CANB); Lower Fly River, Gaima, *Brass* 8283 (BRI); Oriomo River, *Womersley & Havel* NGF 17710 (BRI, CANB).

Acmena hemilampira does not appear to be closely related to any of the other Papuan species of the genus.

5. *Acmena montana* Hartley & Craven, sp. nov.

Arbor parva usque ca. 18 m. alta vel frutex; ramulis glabris, teretibus vel compressis, 2–5 mm. latis; foliis glabris; petiolo 7–10(–20) mm. longo, 2–4 mm. lato; lamina coriacea, in sicco obscure brunnea vel interdum cinerascens, elliptica vel interdum sublanceolata, (12–)15–33 cm. longa, (4.5–)7–16 cm. lata, basi rotundata vel acuta, apice acuminata, venis primariis utrinsecus costa 7–10(–16), plerumque prominentibus; inflorescentiis terminalibus et ex axillis foliatis superioribus orientibus, usque ca. 20 cm. longis, glabris; tubo calycis rubro vel roseo, 6–10 mm. longo, basi stipitato (stipite 2–3 mm. longo), apice 3.5–4 mm. lato; lobis calycis 0.5–0.75 mm. altis; petalis rubris vel roseis, orbicularibus, 2–3 mm. latis; staminibus albis vel cremeis, 0.75–2 mm. longis; pedicellis fructiferis maturis ca. 5 mm. latis; fructibus maturis rubris vel roseis, 2.5–3.5 cm. latis. HOLOTYPUS: *Streimann & Stevens* LAE 53863 (CANB).

DISTRIBUTION. Papua New Guinea; primary and regrowth rain forests; 600–2400 meters.

Papua New Guinea. WESTERN HIGHLANDS DISTRICT: Lufamunda, 1.6 km. NW of Wabag, *Flenley ANU 2035* (CANB); Hagen-Ogelbeng Road, *Robbins 121* (CANB). MADANG DISTRICT: Domainde, *Henty & Sayers NGF 20581* (BRI). EASTERN HIGHLANDS DISTRICT: northeast slopes of Mt. Michael, *Womersley NGF 11709* (BRI); upper Bena Bena Valley, Namaro Forest, *Robbins 1259* (CANB); Wanatabi, 24 km. S of Okapa, *Womersley NGF 17637* (BRI); Noreikora, *Wheeler ANU 5674* (CANB), *ANU 5674A* (CANB); vicinity of Kainantu, behind Nemuka, *Sayers 166* (BRI, CANB); Aiyura Range, *Womersley NGF 3373* (BRI); 1.6 km. W of Akuna, *Hartley 12129* (CANB); Kassam Pass, *Henty & Coode NGF 29200* (BRI), *Womersley & Vandenberg NGF 37413* (BRI, CANB). MOROBE DISTRICT: vicinity of Aseki, *Stevens LAE 54762* (CANB), *Streimann & Stevens LAE 53863* (CANB, holotype), *LAE 53878* (CANB), *LAE 53958* (CANB); Tymne-Wagau Track, *Hartley 11412* (BRI, CANB); Wagau, *Womersley NGF 17864* (BRI, CANB), *Millar NGF 23422* (BRI, CANB); Partep, *Commonwealth Nutrition Survey NSP 45* (CANB); Bulolo, Hump Logging Area, *Streimann NGF 27772* (BRI); Wau-Edie Creek Area, *Frodin & Hill NGF 26383* (BRI, CANB), *Hartley 11716* (CANB), *Henty NGF 16509* (BRI, CANB), *Millar NGF 23065* (BRI), *Womersley NGF 15272* (BRI, CANB), *Womersley & Brass NGF 11015* (BRI); Lake Trist, *Henty NGF 29026* (CANB). SOUTHERN HIGHLANDS DISTRICT: Mt. Ilu, *Gebo UPNG 1662* (CANB); Mabaria Area, below Agunali near Telabo, *Powell UPNG 1622* (CANB); near Habono Resthouse, 10.4 km. W of Mt. Ne, *Frodin NGF 28468* (BRI, CANB); Mendi Valley, above Kiburu, *Schodde 1316* (CANB). **Cultivated.** PAPUA NEW GUINEA: Western Highlands District, Upper Kaugel Valley, Kepaka, Suwake Pena, planted ornamental, *Bowers 483* (CANB).

In their comparatively large flower size, *Acmena montana* and *A. sorongensis* stand apart from the other Papuan species of the genus. Whether or not this is an indication that they are closely related, we do not know. There are rather strong leaf differences between the two, given in the keys to the species, and the fruits of the former are somewhat larger than those of the latter.

6. *Acmena sorongensis* Hartley & Craven, sp. nov.

Arbor parva usque ca. 3 m. alta vel frutex; ramulis glabris, teretibus vel compressis, 3–4 mm. latis; foliis glabris; petiolo ca. 10 mm. longo, 2–4 mm. lato; lamina coriacea, in sicco (praesertim supra) brunneola et plus minusve nitida, lanceolata, 20–45 cm. longa, 4.5–11 cm. lata, basi rotundata vel acuta, apice acuminata, venis primariis utrinsecus costa 12–16, subtus prominentibus; inflorescentiis terminalibus et ex axillis foliatis superioribus orientibus, usque ca. 12 cm. longis, glabris; floribus albis; tubo calycis 6–7 mm. longo, basi stipitato (stipite 1–2 mm. longo), apice 3.5–4 mm. lato; lobis calycis ca. 0.5 mm. altis; petalis orbicularibus, ca. 2 mm. latis; staminibus 1–2 mm. longis; pedicellis fructiferis maturis ca. 1.5 mm. latis; fructibus maturis rubris, ca. 2 cm. latis. HOLOTYPUS: *van Royen 3195* (CANB).

DISTRIBUTION. Irian Jaya, Vogelkop Peninsula in the vicinity of Sorong; primary rain forests at about 60 meters.

Irian Jaya. VOGELKOP PENINSULA: hills S of the town of Sorong, *van Royen* 3334 (CANB); Klabala River SE of Sorong, *van Royen* 3195 (CANB, holotype), 3207 (CANB).

Acmena sorongensis is possibly most closely related to *A. montana* (see under that species).

7. *Acmena triphlebia* (Diels) Hartley & Craven, comb. nov.

Syzygium triphlebium Diels, Bot. Jahrb. 57: 400. 1922. TYPE: *Ledermann* 10288, Northeast New Guinea, Sepik District, Lordberg.

Small to large tree to about 20 m.; branchlets glabrous, with bark tending to crack and flake off, terete or compressed, 3–5 mm. wide. Leaves glabrous; petiole (5–)10–15 mm. long, 1–2 mm. wide; leaf blade subcoriaceous to coriaceous, drying brownish, rarely somewhat glossy above, narrowly to broadly elliptic to lanceolate, 12–17(–22) cm. long, 3–4.5(–7) cm. wide, base rounded to acute, apex acuminate, veins rather prominent, conspicuously paler than the brownish leaf blade surface, main veins about 10 on each side of the midrib. Inflorescences terminal and from the axils of the upper leaves, to about 15 cm. long, glabrous. Flowers white or cream; calyx tube 2.5–3 mm. long, at the base narrowed into a stipe 1–1.5 mm. long, at the apex 2–2.5 mm. wide; calyx lobes about 0.5 mm. high; petals orbicular, about 1 mm. wide; stamens 0.5–1 mm. long. Mature fruiting pedicels about 1 mm. wide; mature fruits white or cream, about 1 cm. wide.

DISTRIBUTION. Irian Jaya, Papua New Guinea; primary and regrowth rain forests; 60–2000 meters.

Irian Jaya. Hollandia, *Kostermans & Soegeng* 134 (L). Papua New Guinea. SEPIK DISTRICT: Amanab-Kamberatore Road, *Streimann & Martin* LAE 52840 (CANB); Lordberg, *Ledermann* 10288 (L, isotype of *Syzygium triphlebium* Diels). WESTERN HIGHLANDS DISTRICT: Pokaris, near Kompiam, *Flenley* ANU 2872 (CANB). MOROBE DISTRICT: Markham Point, about 11.2 km. W of Lae, *Hartley* 10966 (CANB); Upper Watut River, *Havel & Kongara* NGF 17289 (BRI, CANB); Edie Creek Road about 6.4 km. SW of Wau, *Hartley* 11971 (BRI, CANB). SOUTHERN HIGHLANDS DISTRICT: near Hedamari Mission, *Powell* UPNG 2401 (CANB); Lake Kutubu, near Tage, *Schodde* 2244 (CANB).

This plant has anthers and seeds that are characteristic of *Acmena* rather than of *Syzygium*, where it was placed originally by Diels and later by Hartley and Perry (1973). The isotype cited above is in bud and is too young to determine the manner of anther dehiscence. The specimen is otherwise a good match, however, for the other collections cited, of which three are in flower and two are in fruit.

Acmena triphlebia is readily distinguishable from the other Papuan species of the genus by the conspicuously pale veins of its leaves. Its closest relative may be *A. dispansa* (see under that species).

EXCLUDED SPECIES

Syzygium acmenoides Merr. & Perry, Jour. Arnold Arb. 23: 291. 1942. As is noted above, this species was informally referred to *Acmena* by Hartley and Perry (1973: 220). We have examined an isotype and a paratype — *Brass* 8644, Papua, Western District, Wassi Kussa River, Tarara (BRI, isotype), and *Brass* 8465, Papua, Western District, Penzara, between Morehead and Wassi Kussa Rivers (BRI, paratype) — and have found that they are, in fact, correctly placed in *Syzygium*. Both specimens are in fruit, and the seeds do not have the intercotyledonary placental material characteristic of *Acmena*. Also, we have found a single stamen remaining on one of the fruits of the paratype, with anther sacs of *Syzygium* (i.e., elongate, parallel, and laterally dehiscent by a longitudinal slit).

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The numbers in parentheses refer to the corresponding species in the text.

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 (5).

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